SHORT REPORT
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# Solubility of Stearic Acid in Various Organic Solvents and Its Prediction using Non-ideal Solution Models

**Rudi Heryanto,[a,b] Masitah Hasan,[a*] Ezzat Chan Abdullah[a] and Andri Cahyo Kumoro [a,c]**

[a] Department of Chemical Engineering, Faculty of Engineering, University of Malaya Lembah Pantai 50603 Kuala Lumpur, Malaysia.
[b] Department of Chemistry, Faculty of Mathematics and Natural Sciences, Bogor Agricultural University, Bogor, Indonesia.
[c] Department of Chemical Engineering, Faculty of Engineering, Diponegoro University, Semarang, Indonesia.

* Corresponding author, E-mail: masitahhasan@um.edu.my

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**ABSTRACT:** The solubility of stearic acid in ethanol, methanol, ethyl acetate, and acetone has been measured gravimetrically at various temperatures ranging from 301 to 313 K at atmospheric condition. The solubility of stearic acid in ethyl acetate was found to be the highest, followed by ethanol, acetone and methanol. All experimental data were correlated using non-ideal solution models, namely, the modified Apelblat and the Buchowski equations. The calculated results agreed well with the experimental data.

**KEYWORDS:** stearic acid, solubility, organic solvent, Apelblat equation, Buchowski equation.

Stearic acid (octadecanoic acid) is a saturated fatty acid derived from animal and vegetable fats and oils. In Malaysia, it is mainly produced by the oleochemical (palm oil) industry and it has been the primary fatty acid commodity for many years[1]. Stearic acid is used in the manufacture of pharmaceutical products. Recently, it has been used in the development of a drug delivery system, because it is considered to be inert, inexpensive, and biocompatible, as well as of a low toxicity[2]. In addition, stearic acid has been used for a *cyclosporine-A* drug carrier system[3], and for masking the bitter taste of pharmaceutical compounds[4].

Stearic acid has to be prepared in the form of lipospheres for application as a kind of drug delivery system. Lipospheres can be prepared using supercritical fluid technology which utilizes carbon dioxide as an antisolvent by means of co-precipitation. In deploying the co-precipitation process for production of lipospheres, stearic acid as a matrix and an active pharmaceutical ingredient (API), should be able to be dissolved in certain organic solvents. This condition implies that for successful production of lipospheres, solubility of the API and stearic acid must not be infinite[5]. It means that the introduction of supercritical carbon dioxide into the solution should propagate the recrystallization process of stearic acid and the API. Consequently, the solubility data of stearic acid and the API in a particular solvent is needed before employing the co-precipitation process. Furthermore, this information is also necessary in the selection of the most appropriate supercritical antisolvent methods that could be applied[6].

The solubility of stearic acid in several organic solvents had been studied by several research groups[7, 8 9, 10]. Ralston and Hoerr[11] pointed out that the differences in the purities of the stearic acid samples will result in different solubility value. It means that the actual solubility data of stearic acid for each system chosen is necessary to be determined.

This work is part of a research project for the production of stearic acid lipospheres at low temperature using supercritical fluid carbon dioxide. This work investigated the solubility of bulk stearic acid in several organic solvents and at temperatures near the critical point of carbon dioxide. This work also aimed to test the capability of selected solubility correlation models to correlate the experimental data. Two non-ideal solution models, namely the modified Apelblat equation and the Buchowski ($\lambda$H) equation were chosen to correlate the value of solubility data as a function of temperature.

Stearic acid was purchased from Fluka (purity $\geq$ 97%) and used as received without any further treatments. Absolute ethanol (Scharlau, >99.8%), anhydrous methanol (Mallinckrodt, >99.8%), ethyl acetate (Mallinckrodt, 100%), and acetone (Merck, 99.8%) were used as solvents without further purification.

The solubility of stearic acid was measured under isothermal-isobaric conditions. The experimental